

NOTES ON THE OCCURRENCE OF *ZOSTERA* AND
ZANNICHELLIA IN ARCTIC NORTH AMERICA

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THE geographical distribution of *Zostera marina* L. throughout its known range has recently been given by Ostenfeld¹ and in his exhaustive study of the genus Setchell² has added greatly to our morphological and phenological knowledge of this interesting plant.

Hultén³ has already pointed out that to the distribution given by Ostenfeld, l. c., must be added several stations in the northern part of the Bering Sea, since on the Asiatic side the plant was reported by Mertens⁴ from Koraginsk Island while on the American side *Zostera* was reported from Port Clarence by Kjellman.⁵ Ostenfeld, l. c., perhaps refers to the latter record when he observes: "Eine Angabe aus Port Clarence bedarf der Bestätigung,"⁶ although in the distribution given 25 years before by the same author⁷ he cites specimens collected at Port Clarence as having been verified by himself.

Observations made by my brother, Mr. R. T. Porsild, and myself, in 1926, show that *Zostera* occurs in a number of places on the west coast of Alaska from St. Michaels to Golofnin Bay in Norton Sound (*R. T. and A. E. Porsild*, field nos. 1171 and 1410 in the National Herbarium of Canada, Ottawa), and also that, as stated by Kjellman, l. c., it occurs "sparingly and sterile at the head of Port Clarence Bay."

At Golofnin Bay, Alaska, the plant formed extensive colonies in 10–12 feet of water at low tide. At the time of our visit (Aug. 1st) no flowering specimens were observed. The temperature of the surface water, about one quarter of a mile from the shore, was 15.3° C. and, as I was informed that the water in the bay remains sufficiently warm for comfortable bathing throughout the month of August,

¹ Ostenfeld, *Meeresgräser*, Die Pflanzenareale, 1 Reihe, Heft 3 and 4, Karte 38–39, 1927.

² Setchell, *Morphological and Phenological Notes on Zostera marina* L., Univ. of Cal. Publ. in Botany, Vol. XIV, No. 19, pp. 389–452, 1929.

³ Hultén, *Flora of Kamtchatka*, Vol. 3, Kungl. Svenska Vet. Akad. Handl. Ser. 3, Vol. VIII, No. 1, p. 74, 1927.

⁴ Mertens, *Bemerk. ü. d. Flora d. Koragins Insl.*, *Linnaea* V., pp. 60–71, 1830.

⁵ *Fanerogamer fran Vest-Eskimåernas Land*, Vega Exp. Vetensk. Iagttagelser, Vol. II, p. 53, 1883.

⁶ Ostenfeld, *ibid.* p. 49.

⁷ Ostenfeld, *Flora Arctica* I, p. 19, 1902.

it may perhaps be assumed that flowering and fructification takes place.¹

Our specimens from Port Clarence were taken on Aug. 23 and were sterile. No temperature of the water was taken at this place but, on the open coast of Seward Peninsula, near Nome, two weeks earlier the surface temperature near the shore was found to be 15° C. Due to warm currents from the Pacific the sea off the Alaskan side of Bering Strait is much warmer than off the Siberian side. When crossing from Cape Prince of Wales to the Diomed Islands during the latter part of August, the writer, halfway between the Cape and the islands, over a distance of a few miles, observed a drop in the temperature of the surface water from 15.3° to 8.3° C.

In Hudson Bay, 1929, the writer found *Zostera* occurring abundantly in James Bay (*A. E. P.* field No. 4512), where its occurrence had already been suspected by M. A. Howe,² since fragments of *Zostera* leaves, associated with marine algae, had been collected at Charlton Island in the southern part of James Bay. Again in 1930 an isolated colony of *Zostera* was unexpectedly found by the writer at Cape Eskimo on the west coast of Hudson Bay in about latitude 61° (*A. E. P.* field no. 5607).

Further investigation will probably show that *Zostera* occurs extensively in sheltered places in the southern part of Hudson Bay.

James Bay is very shallow and a number of rivers which empty into the bay probably affect the temperature of its water considerably. The well protected strait between Akimiski Island and the west side of the bay is very shallow, especially towards the north end, and no drift ice probably ever passes through here. *Zostera* occurred here in extensive beds along the west coast of Akimiski in water 4–8 feet deep at lowest tide. The place was visited from June 27–29, shortly after the ice had disappeared.

The occurrence of *Zostera* at Cape Eskimo, so far north of its previous known range, is most surprising. No rivers empty into Hudson Bay near Cape Eskimo. The plants were found in the sheltered bay or harbour below the Hudson Bay Co. Post. The harbour is well protected from drift ice by several shoals and bars which almost block the entrance at low tide. The plants formed extensive mats parallel to the shore in from 8–12 feet of water at lowest tide. At the

¹ Compare Setchell l. c. 426.

² Rep. Can. Arctic Exp. 1913–18, Vol. IV. part Bot. pp. 18–30.

time of my visit the plants were from 1 to 3 feet high, showing abundant vegetative growth but no sign of approaching anthesis (July 12).

The fact that the occurrence of *Zostera* at all the above mentioned places was confined to deeper water than is normally its habit in southern waters may perhaps be attributed to the destructive action of the ice on and near the shore,¹ and may very likely account for the fact that the plant has remained undetected in Hudson Bay so long.

According to Setchell² "The vegetative and reproductive activities of *Zostera* are confined to a rise in water temperature from 10° C. to 20° C. The vegetative chiefly carried on in the lower half (rise from 10° C. to 15° C.) and the reproductive carried on solely in the upper half of the interval (15° C. to 20° C.)." Further, that "In the downward march of water temperature the interval below 10° C. whether long or short is a period of quiescence or cold rigor. The upward march from the lowest temperatures experienced to 10° C. is similarly characterized by cold rigor."

Our present knowledge of water temperatures in Hudson Bay is still fragmentary but we know that no warm currents are known to enter into the bay and that drift ice is known to occur in the bay in varying quantities throughout the year, except perhaps in the southern part of the bay during August and September.

Water temperatures in Hudson Bay recorded by ships enroute to Churchill show surface temperatures ranging from 0° to 3°-4° C. during the season of navigation.

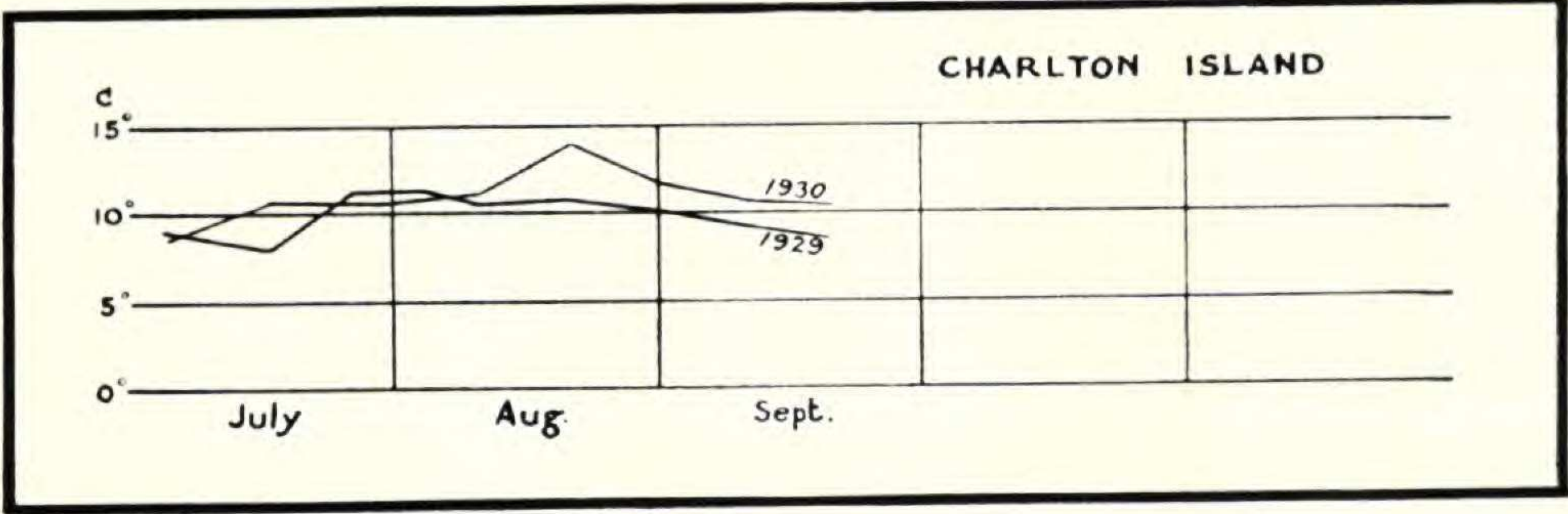
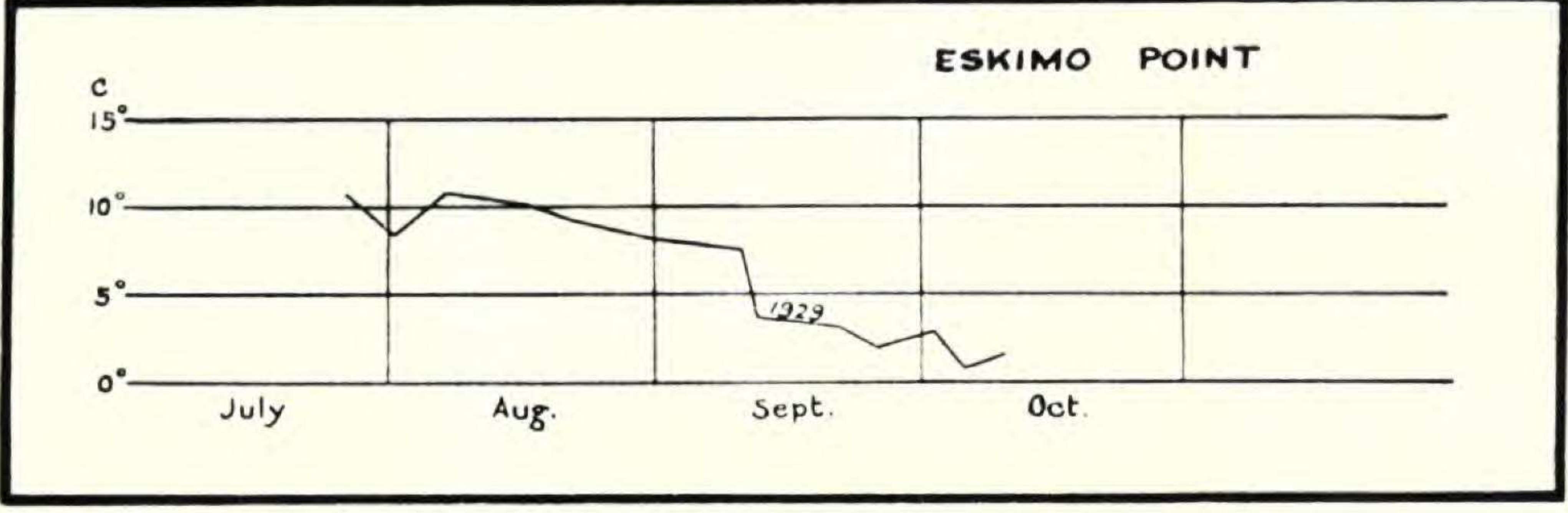
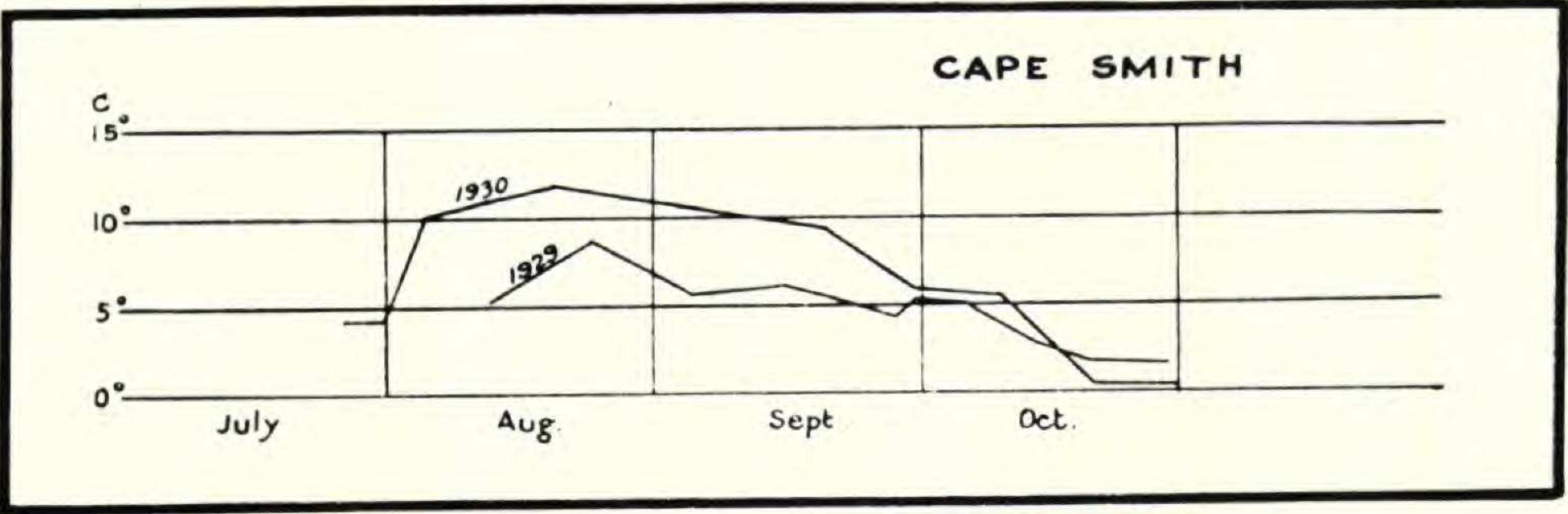
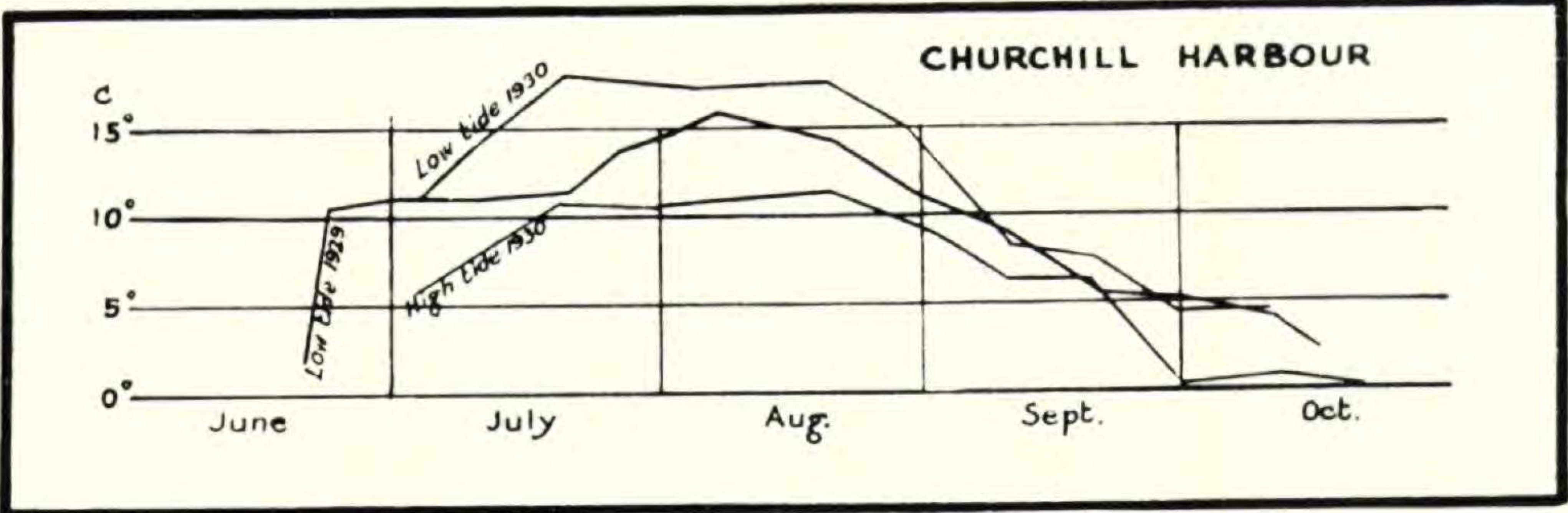
Due to the shallowness of the coastal shelf, especially on the west coast of the bay, the coastal waters are no doubt to some extent affected by insolation at low tide.

The following diagrams represent maximum temperatures during July, August and September from four places in the southern part of the bay, *i. e.* Churchill Harbour and from Cape Eskimo on the west coast of the Bay, from Charlton Island in the southern part of James Bay and from Cape Smith on the east coast of the Bay, and have been compiled from data supplied by the courtesy of the Department of Railways and Canals, Ottawa, Ont.

At Cape Smith, Charlton Island and at Cape Eskimo the readings were taken below the low water mark, about 10 inches below the

¹ See also H. F. Lewis, Can. Field Naturalist, Vol. XLV. No. 3, p. 61, 1931.

² Setchell *ibid* p. 448.



surface, and show that maximum temperatures of the water practically remain below 10° C. throughout the season.

At Churchill temperatures above 15° C. were recorded in the harbour but, although the temperature was taken both at low and high water, it is virtually that of Churchill River.

As *Zostera* in every case was found some distance from the shore, in from 6 to 12 feet of water at lowest tide, we may safely assume that still lower temperatures prevail where the plant is growing and consequently that at least vegetative growth must take place at temperatures below 10° C.

Unfortunately, the writer was unable to revisit any of the localities later in the season in order to ascertain if reproduction occurred, but it is hoped that information regarding this question may be secured at an early date.

The occurrence of *Zostera* in Hudson Bay is rather unexpected and not easily accounted for. No currents enter the Bay except from the Arctic Ocean and from Baffin Strait and this means as a dispersing agent may perhaps be disregarded. It may be considered a relic from a milder, postglacial period, or as having been introduced by migrating water birds.

Zannichellia palustris L. to my knowledge has not previously been recorded from the Arctic.

In the National Herbarium of Canada, Ottawa, is found one sheet, no. 62,667, collected by *W. Spreadborough*, on the west coast of James Bay, Cape Henrietta Maria. The specimens were gathered August 14, 1904, and show an abundance of mature carpels.

We found *Zannichellia* but once, on the north coast of Seward Peninsula, Alaska, in the delta of Buckland River, in latitude 66° 20'. Our specimens likewise were in fruit, on September 7-10, 1926 (*R. T. and A. E. Porsild*, field no. 1499).

Hultén¹ records this plant from several places in Kamtchatka where it occurred in hot springs only, with water temperatures ranging from 25° C. to 30° C.

The above records from Alaska and James Bay are both so far north of the previously known range of this plant, which is otherwise circumpolar in its distribution, that it may perhaps be expected to occur in a number of other places north of its present known range.

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¹ Hultén *ibid.* p. 81.